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DIVIDEND YIELDS AND EXPECTED STOCK RETURNS*

Eugene F. FAMA and Kenneth R. FRENCH

University of Chicago, Chicago, IL 60637, USA

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The power of dividend yields to forecast stock returns, measured by regression R^2, increases with the return horizon. We offer a two-part explanation. (1) High autocorrelation causes the variance of expected returns to grow faster than the return horizon. (2) The growth of the variance of unexpected returns with the return horizon is attenuated by a discount-rate effect – shocks to expected returns generate opposite shocks to current prices. We estimate that, on average, the future price increases implied by higher expected returns are just offset by the decline in the current price. Thus, time-varying expected returns generate 'temporary' components of prices.

1. Introduction

There is much evidence that stock returns are predictable. The common conclusion, usually from tests on monthly data, is that the predictable component of returns, or equivalently, the variation through time of expected returns, is a small fraction (usually less than 3%) of return variances. See, for example, Fama and Schwert (1977), Fama (1981), Keim and Stambaugh (1986), and French, Schwert, and Stambaugh (1987). Recently, however, Fama and French (1987a) find that portfolio returns for holding periods beyond a year have strong negative autocorrelation. They show that under some assumptions about the nature of the price process, the autocorrelations imply that time-varying expected returns explain 25–40% of three- to five-year return variances. Using variance-ratio tests, Poterba and Summers (1987) also estimate that long-horizon stock returns have large predictable components.

Univariate tests on long-horizon returns are imprecise. Although their point estimates suggest strong predictability, Poterba and Summers (1987) cannot reject the hypothesis that stock prices are random walks, even with variance ratios estimated on returns from 1871 to 1985. Fama and French (1987a) find reliable negative autocorrelation in tests on long-horizon returns for the

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1926–1985 period, but subperiod results suggest that the autocorrelation is largely due to the 1926–1940 period. Because sample sizes for long-horizon returns are small, however, it is impossible to make reliable inferences about changes in their time-series properties.

We use dividend/price ratios (D/P), henceforth called dividend yields, to forecast returns on the value- and equal-weighted portfolios of New York Stock Exchange (NYSE) stocks for return horizons (holding periods) from one month to four years. Our tests confirm existing evidence that the predictable (expected) component of returns is a small fraction of short-horizon return variances. Regressions of returns on yields typically explain less than 5% of monthly or quarterly return variances. More interesting, our results add statistical power to the evidence that the predictable component of returns is a larger fraction of the variation of long-horizon returns. Regressions of returns on D/P often explain more than 25% of the variances of two- to four-year returns. In contrast to the univariate tests of Fama and French (1987a) and Poterba and Summers (1987), regressions of returns on yields provide reliable evidence of forecast power for subperiods as well as for the 1927–1986 sample period.

The hypothesis that D/P forecasts returns has a long tradition among practitioners and academics [for example, Dow (1920) and Ball (1978)]. The intuition of the 'efficient markets' version of the hypothesis is that stock prices are low relative to dividends when discount rates and expected returns are high, and vice versa, so that D/P varies with expected returns. There is also evidence, primarily for annual returns, that supports the hypothesis. See, for example, Rozeff (1984), Shiller (1984), Flood, Hodrick, and Kaplan (1986), and Campbell and Shiller (1987). Thus, neither the hypothesis nor the evidence that D/P forecasts returns is new. What we offer are (a) evidence that forecast power increases with the return horizon, (b) an economic story to explain this result, and (c) evidence consistent with the explanation.

Part of the story for why the predictable component of returns becomes more important for longer return horizons is easy to document. If expected returns have strong positive autocorrelation, rational forecasts of one-year returns one to four years ahead are highly correlated. As a consequence, the variance of expected returns grows faster with the return horizon than the variance of unexpected returns – the variation of expected returns becomes a larger fraction of the variation of returns. Our results, like those of others, indicate that expected returns are highly autocorrelated.

The second part of the story for forecast power that increases with the return horizon is more interesting. It starts from the observation that residual variances for regressions of returns on yields (the unexpected returns estimated from the regressions) increase less than in proportion to the return horizon. Our explanation centers on what we call the discount-rate effect, that is, the offsetting adjustment of current prices triggered by shocks to discount rates and expected returns. We find that estimated shocks to expected returns are indeed associated with opposite shocks to prices. The cumulative price effect of these shocks is roughly zero; on average, the expected future price increases implied by higher expected returns are offset by the immediate decline in the current price.

These results are consistent with models [for example, Summers (1986)] in which time-varying expected returns generate mean-reverting components of prices. The interesting economic question, motivated but unresolved by our results, is whether the predictability of returns implied by such temporary price components is driven by rational economic behavior (the investment opportunities of firms and the tastes of investors for current versus risky future consumption) – or by animal spirits.

2. Dividend yields

Consider a discrete-time perfect-certainty model in which $D(t)$, the dividend per share for the time period from $t-1$ to t, grows at the constant rate g, and the market interest rate that relates the stream of future dividends to the stock price $P(t-1)$ at time $t-1$ is the constant r. In this model, the price $P(t-1)$ is

$$P(t-1)=\frac{D(t)}{1+r}\left(1+\frac{1+g}{1+r}+\frac{(1+g)^2}{(1+r)^2}+\cdots\right)=\frac{D(t)}{r-g}. \tag{1}$$

The dividend yield is the interest rate less the dividend growth rate,

$$\frac{D(t)}{P(t-1)}=r-g. \tag{2}$$

In the certainty model, the interest rate r is the discount rate for dividends and the period-by-period return on the stock. The transition from certainty to a model that (a) accommodates uncertain future dividends and discount rates and (b) shows the correspondence between discount rates and time-varying expected returns is difficult. See Campbell and Shiller (1987) and Poterba and Summers (1987). The direct relation between the dividend yield and the interest rate in the certainty model (2) suffices, however, to illustrate that yields are likely to capture variation in expected returns.

3. Variables for the basic regressions

3.1. Returns and dividend yields

Fama and French (1987a) find that the predictability of long-horizon returns implied by negative autocorrelation is stronger for portfolios of small firms. They also find that the return behavior of large- and small-firm portfolios is typified by the value- and equal-weighted portfolios of NYSE stocks constructed by the Center for Research in Security Prices (CRSP). Our tests use continuously compounded returns $r(t, t+T)$ on the two market portfolios for return horizons T of one month, one quarter, and one to four years. The monthly, quarterly, and annual returns are nonoverlapping. The two- to four-year returns are overlapping annual (end-of-year) observations. The sample period for the returns is 1927–1986.

The tests center on regressions of the future return, $r(t, t+T)$, on two measures of the time t dividend yield, $Y(t)$,

$$r(t, t+T) = \alpha(T) + \beta(T)Y(t) + \varepsilon(t, t+T). \tag{3}$$

The yields are constructed from returns, with and without dividends, provided by CRSP. Consider a one-dollar investment in either the value- or equal-weighted market portfolio at the end of December 1925. If dividends are not reinvested, the value of the portfolio at the end of the month m is

$$P(m) = \exp\left[r_0(1) + r_0(2) + r_0(3) + \cdots + r_0(m)\right], \tag{4}$$

where $r_0(m)$ is the continuously compounded without-dividend return for month m. If the continuously compounded with-dividend return is $r(m)$, the dividend on the portfolio in month m is

$$D(m) = P(m-1)\exp[r(m)] - P(m). \tag{5}$$

Two dividend yields, $D(t)/P(t-1)$ and $D(t)/P(t)$, are computed by summing the monthly dividends, from (5), for the year preceding time t and dividing by the value of the portfolio at the beginning or end of the year, from (4). We use annual yields to avoid seasonal differences in dividend payments. The annual yields are used in the estimates of (3) for all return horizons.

3.2. Estimation problems and the definition of the yield

The certainty model (2) shows that the dividend yield is a noisy proxy for expected returns because it also reflects expected dividend growth. Variation in the dividend yield, $Y(t)$, due to changes in the expected growth of dividends can cloud the information in the yield about time-varying expected returns. More generally, any variation in $Y(t)$ that is unrelated to variation in the time t expected return, $E_t r(t, t+T)$, is noise that tends to cause the regression of $r(t, t+T)$ on $Y(t)$ to miss some of the variation in expected returns – it shows up in the regression residuals.

On the other hand, when expected returns vary through time, the discount-rate effect tends to cause estimates of (3) to overstate the variation of expected returns. Suppose an expected return shock at t increases discount rates. If the discount-rate increases are not offset by increases in expected dividends, the expected return shock causes an unexpected decline in $P(t)$. If dividend yields forecast returns, the expected return shock also causes an unexpected increase in $Y(t)$. Thus, because of the discount-rate effect, expected return shocks produce a negative correlation between unexpected returns and contemporaneous yield shocks that tends to produce upward biased slopes in regressions of returns on yields. [See Stambaugh (1986)]. This bias arises only when yields track time-varying expected returns. It does not bias the tests toward false conclusions that yields have forecast power.

Upward bias of the estimated slope in (3) due to the discount-rate effect and downward bias due to variation in $Y(t)$ unrelated to $E_t r(t, t+T)$ can arise for any definition of the yield. Other problems in estimating (3) are specific to the definition of $Y(t)$ as $D(t)/P(t)$ or $D(t)/P(t-1)$. For example, because we would like a yield with up-to-date but known information about expected returns for periods forward from t, $D(t)/P(t)$ is a natural choice. Because stock prices are forward-looking, however, $D(t)$ is old relative to the dividend forecasts in $P(t)$. Good news about future dividends produces a high price $P(t)$ relative to the current dividend $D(t)$ and a low dividend yield $D(t)/P(t)$. Good news about dividends also produces a high return $r(t-T, t)$. The result is a negative correlation between the disturbance $\varepsilon(t-T, t)$ and the time t shock to $D(t)/P(t)$ that again tends to produce upward-baised slopes in regressions of $r(t, t+T)$ on $D(t)/P(t)$.

Table 1 shows that the cross-correlations between one-year stock returns and dividend changes more than a year ahead are close to 0.0. These results suggest that stock prices do not forecast dividend charges more than a year ahead. Thus, variation in the dividend yield due to a denominator price that looks beyond the dividend in the numerator is substantially reduced when $Y(t)$ is defined as $D(t)/P(t-1)$, where $P(t-1)$ is the price at the beginning of the year covered by $D(t)$. If stock prices do not forecast dividend changes more than a year ahead, the dividend forecasts in $P(t-1)$ will not produce variation in $D(t)/P(t-1)$, and they will not produce upward-biased slopes in regressions of $r(t, t+T)$ on $D(t)/P(t-1)$.

Confident conclusions that $D(t)/P(t)$ or $D(t)/P(t-1)$ produces regressions that overstate or understate the variation of expected returns can not be made on *a priori* grounds. $D(t)/P(t-1)$ is more conservative. Any upward bias in the slopes it produces occurs only when expected returns vary through time (the discount-rate effect). Thus, regressions that use $D(t)/P(t-1)$ are more likely to avoid a false positive conclusion that yields track expected returns. They are, however, also more likely to be too conservative. The deviation of $D(t)$ from its expected value at $t-1$ is noise that tends to cause regressions of $r(t, t+T)$ on $D(t)/P(t-1)$ to understate the variation of expected returns. Moreover, because $P(t-1)$ can only reflect information

Table 1

Cross-correlations between one-year continuously-compounded returns and current and future one-year changes in the log of annual dividends for the CRSP value-weighted and equal-weighted NYSE portfolios.

$\mathrm{Cor}[r(t-1,t), \ln D(t+i) - \ln D(t+i-1)]$

Period	Lead i: 0	1	2	3	4	$s(0)$[a]
	Value-weighted nominal returns					
1927–1986	0.10	0.68	0.22	0.03	−0.16	0.13
1927–1956	0.13	0.78	0.26	0.08	−0.18	0.18
1957–1986	−0.09	0.37	0.05	−0.29	−0.10	0.18
1941–1986	−0.12	0.26	0.00	−0.16	−0.05	0.15
	Equal-weighted nominal returns					
1927–1986	0.17	0.72	0.21	0.04	−0.20	0.13
1927–1956	0.19	0.80	0.23	0.08	−0.22	0.18
1957–1986	0.09	0.46	0.13	−0.11	−0.10	0.18
1941–1986	0.03	0.46	0.11	−0.01	−0.12	0.15

[a] $s(0)$ is the asymptotic standard error of the contemporaneous cross-correlation, that is, $n^{-0.5}$, where n is the sample size. Real returns produce correlations similar to those shown for nominal returns.

about expected returns available at $t-1$, $D(t)/P(t-1)$ is about a year out of date with respect to expected returns measured forward from t. If current shocks have a decaying effect on expected returns, using an 'old' yield to track expected returns is likely to understate the variation of expected returns. We present results for the more timely measure, $D(t)/P(t)$, as well as for $D(t)/P(t-1)$.

4. Summary statistics

Table 2 shows summary statistics for one-year nominal and real returns on the value- and equal-weighted portfolios. Standard deviations of returns are about 50% higher during the 1927–1956 period than during the 1957–1986 period. As in Blume (1968), the high variability of returns for 1927–1956 is largely due to the 1927–1940 period. The standard deviations of returns are similar for 1957–1986 and 1941–1986. We shall find that the regression results are also similar for these periods.

Like stock returns, dividend changes are more variable toward the beginning of the sample. The standard deviations of year-to-year changes in the logs of annual dividends on the value- and equal-weighted portfolios for 1957–1986 are about 25% of those for 1927–1956. Dividend variability declines relative to that of returns. During the 1927–1956 period, dividend changes are almost as

Table 2

Summary statistics for one-year nominal and real returns, dividend yields, and changes in the logs of annual dividends for the CRSP value-weighted and equal-weighted NYSE portfolios.[a]

Period	Mean	S.D.	Autocorrelations 1	2	3	4	5	Mean	S.D.	Autocorrelations 1	2	3	4	5
			Value-weighted nominal returns							Equal-weighted nominal returns				
1927–1986	0.092	0.206	0.10	−0.20	−0.07	−0.15	−0.02	0.125	0.280	0.13	−0.18	−0.14	−0.23	−0.11
1927–1956	0.088	0.244	0.21	−0.10	−0.18	−0.44	−0.03	0.124	0.336	0.19	−0.11	−0.23	−0.51	−0.12
1957–1986	0.096	0.163	−0.16	−0.39	0.19	0.30	0.06	0.125	0.216	−0.04	−0.36	0.13	0.26	−0.07
1941–1986	0.112	0.155	−0.08	−0.33	0.03	0.27	0.10	0.143	0.210	0.04	−0.28	−0.07	0.17	−0.01
			Value-weighted real returns							Equal-weighted real returns				
1927–1986	0.062	0.208	0.04	−0.24	−0.08	−0.09	0.05	0.094	0.282	0.08	−0.22	−0.15	−0.19	−0.04
1927–1956	0.074	0.239	0.11	−0.17	−0.22	−0.40	0.06	0.109	0.334	0.13	−0.15	−0.26	−0.47	−0.04
1957–1986	0.050	0.174	−0.10	−0.38	0.18	0.29	0.06	0.079	0.224	−0.03	−0.39	0.11	0.26	−0.05
1941–1986	0.068	0.173	−0.01	−0.29	−0.01	0.24	0.16	0.099	0.223	0.04	−0.31	−0.12	0.15	0.05
			Value-weighted $\ln D(t+1) - \ln D(t)$							Equal-weighted $\ln D(t+1) - \ln D(t)$				
1927–1986	0.041	0.133	0.30	−0.10	−0.17	−0.20	−0.00	0.079	0.220	0.31	−0.15	−0.16	−0.28	−0.20
1927–1956	0.028	0.184	0.28	−0.13	−0.21	−0.23	−0.00	0.083	0.304	0.30	−0.18	−0.17	−0.30	−0.21
1957–1986	0.055	0.041	0.54	0.30	0.22	0.08	−0.19	0.075	0.077	0.55	0.37	0.12	−0.09	−0.22
1941–1986	0.058	0.058	0.25	0.10	0.11	−0.21	−0.34	0.089	0.087	0.33	0.21	0.14	0.12	0.02
			Value-weighted $D(t)/P(t-1)$							Equal-weighted $D(t)/P(t-1)$				
1926–1985	0.047	0.012	0.81	0.59	0.48	0.44	0.39	0.044	0.013	0.78	0.51	0.36	0.30	0.28
1926–1955	0.053	0.009	0.64	0.18	−0.14	−0.25	−0.10	0.048	0.015	0.79	0.50	0.26	0.18	0.28
1956–1985	0.040	0.010	0.79	0.65	0.64	0.58	0.41	0.040	0.010	0.65	0.34	0.32	0.30	0.10
1940–1985	0.046	0.013	0.84	0.67	0.57	0.50	0.41	0.046	0.014	0.78	0.51	0.39	0.40	0.38

[a]The one-year value- and equal-weighted portfolio returns are continuously compounded. Real returns are calculated by summing the differences between monthly continuously compounded nominal returns and the one-month inflation rate, calculated from the U.S. Consumer Price Index (CPI). $D(t)/P(t-1)$ is the ratio of dividends for year t to the value of the portfolio at the end of year $t-1$. The time periods for $D(t)/P(t-1)$ are those for $D(t)$. The periods for $D(t)/P(t-1)$ match the periods to be used in the regressions of one-year returns on the yields. For example, the returns for 1927–1986 are regressed on the yields for 1926–1985.

variable as returns. After 1940 returns are more than 2.4 times as variable as dividend changes.

Dividend variability also declines relative to the variability of earnings. For the 1927–1956 period, the standard deviation of annual changes in the log of annual earnings on the Standard and Poor's (S&P) Composite Index (0.259) is about 43% greater than that of changes in annual Index dividends (0.181). For 1957–1986, the standard deviation of changes in earnings (0.113) is more than three times that of dividend changes (0.037).

The estimated speed of adjustment of dividends to target dividends in Lintner's (1956) dividend model also declines over the sample period. Lintner postulates that a firm's target dividend $D^*(t)$ for year t is a constant fraction of earnings $E(t)$,

$$D^*(t) = kE(t). \tag{6}$$

The change in the actual dividends from $t-1$ to t is assumed to follow a partial adjustment model,

$$D(t) - D(t-1) = a + s[D^*(t) - D(t-1)] + u(t). \tag{7}$$

When this model is fitted to the annual S&P earnings and dividends, the estimated speed of adjustment s drops from 49% per year for 1927–1956 to 12% per year for 1941–1986, and 11% for 1957–1986.

In short, the data suggest systematic changes in the dividend policies of firms (toward dividends that are smoother relative to earnings) during the sample period. For our purposes, changes in dividend policy are important because they can produce variation in yields that obscures information about expected returns or causes the relation between the yield and expected returns to change through time.

Finally, table 2 shows summary statistics for end-of-year observations on the yield $D(t)/P(t-1)$, the explanatory variable in regressions of $r(t, t+T)$ on $D(t)/P(t-1)$ for one- to four-year returns. The first-order autocorrelations of $D(t)/P(t-1)$ are large, but the autocorrelations decay across longer lags. If yields track expected returns, high first-order autocorrelation implies persistence in expected returns. The decay of the autocorrelations across longer lags then suggests the appealing conclusion that, though highly autocorrelated, expected returns have a mean-reverting tendency.

5. Regressions for nominal and real returns

The change in return variability around 1940 suggests that a weighted least squares (WLS) approach that deflates the observations by estimates of return variability will produce more efficient estimates of regressions of returns on dividend yields. Some of our more interesting analysis, however, involves explaining why the expected return variation tracked by yields is a larger fraction of the variation of returns for longer return horizons. WLS estimates would complicate the analysis by changing the meaning of what is being explained. Thus the text uses ordinary least squares (OLS) estimates. WLS regressions produce slopes that are similar to OLS slopes, however, and so produce similar estimates of the variation in expected returns. In fact, for periods that overlap the shift in return variances around 1940 (for example, 1927–1986 and 1927–1956), WLS estimates actually give a stronger view of the statistical reliability of return forecasts from yields. The WLS estimates are available on request.

Tables 3 and 4 summarize the OLS regressions of the value- and equal-weighted portfolio returns, $r(t, t+T)$, on their *ex ante* yields, $D(t)/P(t-1)$ and $D(t)/P(t)$. Because the regressions are the central evidence on the variation of expected returns, the results are shown in some detail. Each table splits the 1927–1986 sample into 30-year periods (1927–1956 and 1957–1986). Results for the 1941–1986 period of roughly constant return variances are also shown. Estimates of regression slopes and their t-statistics for 1946–1986 and 1936–1986 (not shown) are close to those for 1941–1986. Finally, to illustrate that the results are similar for different definitions of returns, regressions for nominal and real returns are shown.

5.1. Nominal returns

All the regression slopes in tables 3 and 4 are positive. For value-weighted nominal returns, regressions that use the less timely $D(t)/P(t-1)$ as the explanatory variable produce only one slope less than 1.8 standard errors from 0.0. Slopes for value-weighted nominal returns more than 2.0 standard errors from 0.0 are the rule, and slopes more than 2.5 standard errors from 0.0 are common. For 1941–1986, the longest period of roughly constant return variances, all the slopes for value-weighted nominal returns are more than 2.4 standard errors from 0.0.

Except for the 1927–1956 period, the regressions of equal-weighted nominal returns on $D(t)/P(t-1)$ are also strong evidence that expected returns vary through time. For the 1927–1986 sample period and the 1941–1986 and 1957–1986 subperiods, the regression slopes for equal-weighted nominal returns are typically more than 2.0 standard errors from 0.0. Moreover, the weak results for equal-weighted returns for 1927–1956 are a consequence of the high variability of returns in the early years of the sample. The slopes for 1927–1956 are similar to those for the 1941–1986 period of lower return variances, and the 1941–1986 slopes are all more than 2.6 standard errors from 0.0.

Regressions that use the more timely $D(t)/P(t)$ to explain nominal returns also produce strong evidence of forecast power for the 1927–1986 period and

Table 3

Regressions of nominal and real CRSP value-weighted NYSE portfolio returns on dividend yields.[a]

$$r(t, t+T) = a + bY(t) + e(t, t+T)$$

Return horizon		Nominal returns								Real returns							
		$Y(t) = D(t)/P(t-1)$				$Y(t) = D(t)/P(t)$				$Y(t) = D(t)/P(t-1)$				$Y(t) = D(t)/P(t)$			
T	N	b	$t(b)$	R^2	$s(e)$	b	$t(b)$	R^2	$s(e)$	b	$t(b)$	R^2	$s(e)$	b	$t(b)$	R^2	$s(e)$
								1927–1986									
M	720	0.53	2.99	0.01	0.06	0.21	1.40	0.00	0.06	0.49	2.76	0.01	0.06	0.28	1.83	0.00	0.06
Q	240	1.12	1.87	0.01	0.11	1.07	2.10	0.01	0.11	1.04	1.71	0.01	0.11	1.26	2.48	0.02	0.11
1	60	5.37	2.40	0.07	0.20	2.47	1.27	0.01	0.20	5.32	2.35	0.07	0.20	3.35	1.72	0.03	0.20
2	59	9.10	2.18	0.10	0.29	7.38	2.04	0.09	0.29	9.08	2.31	0.11	0.28	8.77	2.59	0.15	0.28
3	58	11.56	2.14	0.13	0.33	9.94	2.21	0.13	0.33	11.73	2.51	0.15	0.31	11.53	2.93	0.21	0.30
4	57	12.68	1.93	0.13	0.37	12.86	2.43	0.19	0.36	13.44	2.46	0.17	0.33	14.43	3.25	0.29	0.31
								1927–1956									
M	360	0.93	2.77	0.02	0.07	0.17	0.69	−0.00	0.07	0.78	2.33	0.01	0.07	0.27	1.08	0.00	0.07
Q	120	1.79	1.55	0.01	0.14	1.16	1.41	0.01	0.14	1.38	1.20	0.00	0.14	1.42	1.75	0.02	0.13
1	30	11.04	2.49	0.15	0.22	1.50	0.46	−0.03	0.25	9.61	2.16	0.11	0.23	2.62	0.83	−0.01	0.24
2	29	22.49	2.88	0.28	0.33	8.92	1.49	0.07	0.37	19.43	2.65	0.23	0.32	10.16	1.89	0.13	0.34
3	28	29.24	2.86	0.33	0.39	15.27	2.21	0.18	0.43	24.73	2.74	0.29	0.36	15.94	2.73	0.26	0.36
4	27	28.16	2.25	0.24	0.46	20.86	3.14	0.30	0.44	23.00	2.21	0.22	0.40	20.39	3.70	0.40	0.35
								1957–1986									
M	360	0.53	2.31	0.01	0.04	0.68	2.66	0.02	0.04	0.42	1.79	0.01	0.04	0.51	1.95	0.01	0.04
Q	120	1.40	1.82	0.02	0.08	2.33	2.78	0.05	0.08	1.11	1.40	0.01	0.08	1.87	2.14	0.03	0.08
1	30	5.60	1.86	0.08	0.16	9.32	3.02	0.22	0.14	4.58	1.39	0.03	0.17	7.74	2.21	0.12	0.16
2	29	7.51	1.89	0.09	0.20	16.40	4.04	0.45	0.16	5.68	1.10	0.02	0.23	14.06	2.53	0.25	0.20
3	28	10.41	3.01	0.21	0.19	17.12	4.12	0.51	0.15	8.16	1.38	0.08	0.23	14.03	2.05	0.24	0.21
4	27	15.05	3.37	0.38	0.18	19.69	3.87	0.57	0.15	12.48	1.57	0.17	0.24	16.21	1.83	0.26	0.23
								1941–1986									
M	552	0.39	2.95	0.01	0.04	0.36	2.59	0.01	0.04	0.37	2.73	0.01	0.04	0.32	2.20	0.01	0.04
Q	184	1.07	2.47	0.03	0.08	1.20	2.64	0.03	0.08	1.04	2.28	0.02	0.08	1.07	2.23	0.02	0.08
1	46	4.46	2.62	0.12	0.15	5.09	2.88	0.14	0.14	4.40	2.29	0.09	0.17	4.82	2.38	0.09	0.16
2	45	7.15	3.04	0.17	0.19	10.34	4.18	0.35	0.17	7.21	2.36	0.13	0.23	10.26	3.15	0.25	0.21
3	44	9.42	4.77	0.29	0.19	12.94	5.68	0.51	0.15	9.66	2.91	0.21	0.24	13.10	3.53	0.36	0.21
4	43	12.75	5.49	0.49	0.17	15.35	5.62	0.64	0.14	13.34	3.18	0.36	0.23	15.71	3.31	0.45	0.22

[a] N is the number of observations. $P(t)$ is the time t price. $D(t)$ is the dividend for the year preceding t. $r(t, t+T)$ is the continuously compounded return from t to $t+T$. The regressions for T = one month (M), one quarter (Q), and one year use nonoverlapping returns. The regressions for two- to four-year returns use overlapping annual observations. The standard errors in the t-statistic $t(b)$ for the two- to four-year slopes are adjusted for the sample autocorrelation of overlapping residuals with the method of Hansen and Hodrick (1980). Regression slopes and t-statistics for 1946–1986 and 1936–1986 (not shown) are close to those for 1941–1986.

Table 4

Regressions of nominal and real CRSP equal-weighted NYSE portfolio returns on dividend yields.[a]

$$r(t,t+T)=a+bY(t)+e(t,t+T)$$

Return horizon		Nominal returns								Real returns							
		$Y(t)=D(t)/P(t-1)$				$Y(t)=D(t)/P(t)$				$Y(t)=D(t)/P(t-1)$				$Y(t)=D(t)/P(t)$			
T	N	b	$t(b)$	R^2	$s(e)$	b	$t(b)$	R^2	$s(e)$	b	$t(b)$	R^2	$s(e)$	b	$t(b)$	R^2	$s(e)$
								1927–1986									
M	720	0.52	2.40	0.01	0.07	0.21	0.97	−0.00	0.07	0.45	2.10	0.00	0.07	0.24	1.15	0.00	0.08
Q	240	1.07	1.41	0.00	0.15	1.28	1.74	0.01	0.15	0.91	1.19	0.00	0.16	1.40	1.90	0.01	0.15
1	60	5.87	2.21	0.06	0.27	2.69	1.06	0.00	0.28	5.48	2.04	0.05	0.27	3.38	1.33	0.01	0.28
2	59	10.75	2.14	0.10	0.40	9.91	2.15	0.10	0.40	10.06	2.05	0.09	0.40	11.23	2.54	0.14	0.39
3	58	13.60	2.09	0.12	0.47	14.68	2.63	0.17	0.46	12.38	2.02	0.10	0.46	16.08	3.14	0.22	0.43
4	57	14.28	1.96	0.11	0.53	17.96	2.95	0.21	0.49	12.64	1.86	0.09	0.50	18.91	3.47	0.27	0.45
								1927–1956									
M	360	0.49	1.50	0.00	0.09	0.06	0.20	−0.00	0.09	0.38	1.18	0.00	0.09	0.10	0.34	−0.00	0.09
Q	120	0.85	0.73	−0.00	0.19	0.91	0.83	−0.00	0.19	0.56	0.48	−0.01	0.19	1.03	0.95	−0.00	0.19
1	30	5.14	1.25	0.02	0.33	0.38	0.10	−0.04	0.34	4.21	1.02	0.00	0.33	1.13	0.31	−0.03	0.34
2	29	11.97	1.45	0.09	0.50	7.86	1.11	0.03	0.52	10.18	1.28	0.06	0.49	8.97	1.35	0.06	0.49
3	28	16.05	1.44	0.11	0.61	14.92	1.73	0.13	0.61	12.92	1.23	0.07	0.59	15.65	2.00	0.17	0.56
4	27	13.92	1.11	0.05	0.71	19.35	2.03	0.19	0.65	9.58	0.84	0.01	0.66	18.93	2.23	0.22	0.59
								1957–1986									
M	360	0.87	2.76	0.02	0.05	0.99	2.80	0.02	0.05	0.76	2.37	0.01	0.05	0.82	2.30	0.01	0.05
Q	120	2.24	2.08	0.03	0.10	3.68	3.18	0.07	0.10	1.97	1.78	0.02	0.11	3.28	2.75	0.05	0.10
1	30	10.01	2.68	0.18	0.20	12.58	3.28	0.25	0.19	9.31	2.35	0.13	0.21	11.56	2.79	0.19	0.20
2	29	13.02	2.39	0.16	0.28	23.85	4.59	0.51	0.21	11.82	1.93	0.11	0.30	22.86	3.83	0.42	0.24
3	28	16.22	2.66	0.22	0.29	23.87	3.84	0.45	0.24	14.77	2.14	0.17	0.31	22.84	3.30	0.39	0.26
4	27	21.99	3.01	0.35	0.30	25.98	3.39	0.42	0.28	20.26	2.47	0.28	0.32	24.85	3.00	0.37	0.30
								1941–1986									
M	552	0.51	3.21	0.02	0.05	0.45	2.57	0.01	0.05	0.51	3.18	0.02	0.05	0.44	2.49	0.01	0.05
Q	184	1.42	2.64	0.03	0.10	1.64	2.78	0.04	0.10	1.47	2.64	0.03	0.10	1.63	2.67	0.03	0.10
1	46	6.75	3.35	0.19	0.19	7.05	3.15	0.17	0.19	6.99	3.24	0.17	0.20	7.27	3.03	0.15	0.21
2	45	10.38	3.15	0.22	0.27	14.64	4.02	0.37	0.24	10.89	3.07	0.21	0.29	15.51	4.00	0.36	0.26
3	44	11.90	2.94	0.23	0.30	17.71	4.02	0.43	0.26	12.37	2.96	0.22	0.32	18.99	4.25	0.45	0.27
4	43	13.68	2.76	0.26	0.32	19.00	3.60	0.43	0.28	14.19	2.90	0.27	0.33	20.50	3.97	0.47	0.28

[a] N is the number of observations. $P(t)$ is the time t price. $D(t)$ is the dividend for the year preceding t. $r(t,t+T)$ is the continuously compounded return from t to $t+T$. The regressions for T = one month (M), one quarter (Q), and one year use nonoverlapping returns. The regressions for two- to four-year returns use overlapping annual observations. The standard errors in the t-statistic $t(b)$ for the two- to four-year slopes are adjusted for the sample autocorrelation of overlapping residuals with the method of Hansen and Hodrick (1980). Regression slopes and t-statistics for 1946–1986 and 1936–1986 (not shown) are close to those for 1941–1986.

especially for 1941–1986 and 1957–1986. For the two post-1940 periods, the slopes for $D(t)/P(t)$ are more than 2.5 standard errors from 0.0 for both market portfolios and for all return horizons. Slopes more than 4.0 standard errors from 0.0 are common.

5.2. *Real returns*

The slopes for real returns in tables 3 and 4 are typically close to those for nominal returns. Because the real and nominal regressions have the same explanatory variable, similar slopes indicate that variation in expected nominal returns translates into similar variation in expected real returns. If the market is efficient, the results indicate that dividend yields signal variation in equilibrium expected real returns.

Fama and French (1987b) show regressions of excess stock returns on dividend yields. Excess returns for horizons beyond a month are calculated by cumulating the differences between monthly nominal stock returns and the one-month U.S. Treasury bill rate. The results for excess returns are similar to those for real returns in tables 3 and 4. Thus the variation in expected real stock returns tracked by dividend yields is also present in the expected premiums of stock returns over one-month bill returns.

5.3. *The behavior of the regression slopes*

The slopes in the regressions of real or nominal returns $r(t, t+T)$ on $Y(t)$ increase with the return horizon T. When the explanatory variable is $D(t)/P(t-1)$, the increase in the slopes is roughly proportional to T for horizons to one year, but less than proportional to T for two- to four-year returns. For the more timely $D(t)/P(t)$ and for periods after 1940, the slopes increase roughly in proportion to T for return horizons to four years, but more slowly thereafter.

This behavior of the slopes has an appealing explanation. The slope in the regression of the T-period return $r(t, t+T)$ on $Y(t)$ is the sum of the slopes in the T regressions of the one-period returns, $r(t, t+1), \ldots, r(t+T-1, t+T)$, on $Y(t)$. Slopes in regressions of $r(t, t+T)$ on $Y(t)$ that increase in proportion to T for horizons of one or two years thus imply that variation in $Y(t)$ signals similar variation in one-period expected returns out to one or two years. Slopes that increase less than in proportion to T for longer return horizons suggest that $Y(t)$ signals less variation in more distant one-period expected returns. This behavior of the slopes suggests that expected returns are highly autocorrelated but slowly mean-reverting. The decay of the autocorrelations of $D(t)/P(t-1)$ in table 2 also suggests slow mean reversion.

5.4. Other tests

The intuition of the hypothesis that dividend yields forecast returns is that stock prices are low relative to dividends when discount rates and expected returns are high, and vice versa, so that yields capture variation in expected returns. There is a similar intuition for earnings/price ratios (E/P).

We have estimated regressions (available on request) of value- and equal-weighted NYSE returns, $r(t, t+T)$, on $E(t)/P(t-1)$ and $E(t)/P(t)$. $E(t)$ is earnings per share on the Standard and Poor's (S&P) Composite Index for calendar year t, as reported by S&P. $P(t)$ is the value of the index at the end of the year. In many ways the E/P results are similar to the D/P results. For example, the regression slopes and R^2 produced by E/P increase with the return horizon. The t's for the slopes suggest that E/P has reliable forecast power. E/P tends, however, to have less explanatory power than D/P.

Earnings are more variable than dividends. (See section 4). If this higher variability is unrelated to the variation in expected returns, E/P is a noisier measure of expected returns than D/P. This 'numerator noise' argument may also explain why the forecast power of dividend yields is higher in the periods after 1940, when the variability of dividends declines substantially relative to the variability of returns.

It would seem that a solution to problems caused by noise in the numerator of E/P or D/P is to use $1/P$ as the forecast variable. Miller and Scholes (1982) show that the cross-section of $1/P$ for common stocks helps explain the cross-section of expected returns. Suppose, however, that reinvestment of earnings causes stock prices to have an upward-drifting nonstationary component. Then $1/P$ is nonstationary (it tends to drift downward), and it is not a good variable for tracking expected returns in time-series tests. In fact, for the value- and equal-weighted NYSE portfolios, regressions (not shown) of $r(t, t+T)$ on $1/P(t)$, where $P(t)$ is the value of the portfolio at t produce slopes and R^2 close to 0.0.

6. Out-of-sample forecasts

The slopes in tables 3 and 4 are apparently strong evidence that yields signal variation in expected returns. Given the uncertainty about the bias of the slopes, however, further testing is in order. One approach is to use the regressions to forecast out-of-sample returns. We forecast returns for the 20-year period 1967–1986. Each forecast is from a regression of $r(t, t+T)$ on $Y(t)$ estimated with returns that begin and end in the preceding 30-year period. For example, to forecast the first one-year return (1967), we use coefficients estimated with the 30 one-year returns for 1937–1966. To forecast the first four-year return (1967–1970), we use coefficients estimated with the

27 overlapping annual observations on the four-year returns that begin and end in the 1937–1966 period. For monthly and quarterly returns, the 30-year estimation period rolls forward in monthly or quarterly steps. For one- to four-year returns, the estimation period rolls forward in annual increments.

We start the estimation periods in 1937 because of the evidence that returns and yields behave differently during the first ten years of the sample. Because the overlap of annual observations on multiyear returns reduces effective sample sizes, we judge that estimation periods shorter than 30 years would not produce meaningful forecasts of two- to four-year returns. The 1937 starting date and the choice of 30-year estimation periods then limit the forecast period to 1967–1986. For this 20-year forecast period, there are only five nonoverlapping forecasts of four-year returns.

6.1. Perspective

With respect to possible bias of the regression slopes, the out-of-sample tests are conservative. They correct for bias that causes the in-sample slopes to overstate the variation of expected returns, but they leave the estimation problems that cause the regressions to understate the variation of expected returns.

Thus, section 3 argues that negative correlation between shocks to returns and yields (because of the discount-rate effect or because yields and returns respond to dividend forecasts) produces positive bias in the slope estimates for dividend yields, with possibly more bias in the slopes for $D(t)/P(t)$ than in the slopes for $D(t)/P(t-1)$. The bias means that in-sample R^2 tend to overstate explanatory power. The bias decreases out-of-sample forecast power, however, so out-of-sample tests are appropriately punitive.

On the other hand, yields contain noise (variation unrelated to expected returns) that tends to cause estimates of (3) to understate the variation of expected returns. Since the noise reduces both in-sample and out-of-sample forecast power, out-of-sample tests do not correct for this source of error. Likewise, if regressions of $r(t, t+T)$ on the less timely $D(t)/P(t-1)$ understate the variation of expected returns, the understatement remains in out-of-sample forecasts.

6.2. Results

Table 5 summarizes the mean squared errors (MSE) of the out-of-sample forecasts. To compare the forecasts with the in-sample fit of the regressions, the MSE are reported as R^2. Specifically, the MSE R^2 in table 5 is $1-(\text{MSE}/s^2[r(t, t+T)])$, where $s^2[r(t, t+T)]$ is the out-of-sample variance of the forecasted return. The out-of-sample forecasts cover 1967–1986. The

Table 5

Mean squared error R^2 for out-of-sample forecasts for NYSE portfolio returns for 1967–1986 and R^2 for in-sample forecasts for 1957–1986.[a]

Return horizon	$D(t)/P(t-1)$		$D(t)/P(t)$		$D(t)/P(t-1)$		$D(t)/P(t)$	
T	Out	In	Out	In	Out	In	Out	In
	Value-weighted nominal returns				Value-weighted real returns			
M	0.01	0.01	0.02	0.02	0.01	0.01	0.01	0.01
Q	0.03	0.02	0.06	0.05	0.01	0.01	0.03	0.03
1	0.13	0.08	0.[illegible]4	0.22	0.07	0.03	0.13	0.12
2	0.20	0.09	0.43	0.45	0.05	0.02	0.22	0.25
3	0.24	0.21	0.48	0.51	−0.18	0.08	0.00	0.24
4	0.35	0.38	0.50	0.57	−0.38	0.17	−0.26	0.26
	Equal-weighted nominal returns				Equal-weighted real returns			
M	0.01	0.02	0.01	0.02	0.01	0.01	0.01	0.01
Q	0.02	0.03	0.04	0.07	0.02	0.02	0.04	0.05
1	0.17	0.18	0.16	0.25	0.17	0.13	0.15	0.19
2	0.18	0.16	0.34	0.51	0.18	0.11	0.35	0.42
3	0.16	0.22	0.35	0.45	0.10	0.17	0.36	0.38
4	0.23	0.35	0.36	0.42	0.09	0.28	0.36	0.37

[a] The out-of-sample (Out) mean squared error R^2 is $1-(\mathrm{MSE}/s^2[r(t,t+T)])$. Each out-of-sample forecast is made with coefficients estimated using the previous 30 years of returns and yields. Monthly (M), quarterly (Q), and one-year forecasts are for nonoverlapping periods. The two- to four-year forecasts are overlapping annual observations. The in-sample regressions are in tables 3 and 4.

in-sample $\bar{R}^2$ for 1957–1986, the most comparable period in tables 3 and 4, are also shown in table 5.

For horizons out to two years, the MSE R^2 for the 1967–1986 out-of-sample return forecasts from $D(t)/P(t-1)$ and $D(t)/P(t)$ are close to the in-sample R^2 for 1957–1986. The signs of the differences between the in-sample R^2 and the out-of-sample MSE R^2 are random. The MSE R^2 for forecasts of three- and four-year value-weighted nominal returns from $D(t)/P(t-1)$ are also similar to the in-sample R^2. Otherwise, the MSE R^2 produced by $D(t)/P(t-1)$ deteriorate relative to the in-sample R^2 in three- and four-year forecasts. (The obvious worst cases are the negative MSE R^2 for forecasts of value-weighted three- and four-year real returns.) The results for longer return horizons are less reliable, however, because they involve fewer independent returns during the 20-year forecast period. The uniform similarity of in- and out-of-sample forecast power for horizons to two years suggests that regressions of $r(t,t+T)$ on either $D(t)/P(t-1)$ or $D(t)/P(t)$ do not produce strongly biased slopes and thus biased estimates of explanatory power.

The out-of-sample forecasts do not confirm that $D(t)/P(t)$ slopes are more biased than $D(t)/P(t-1)$ slopes. The out-of-sample forecast power of

$D(t)/P(t)$ actually matches in-sample explanatory power better than $D(t)/P(t-1)$. Only the out-of-sample MSE R^2 for forecasts of three- and four-year value-weighted real returns from $D(t)/P(t)$ are much less than the in-sample R^2. Thus there is no evidence in the out-of-sample tests that slope estimates for the more timely $D(t)/P(t)$ exaggerate the variation in expected returns.

On the other hand, like the in-sample R^2, the MSE R^2 for out-of-sample forecasts from $D(t)/P(t)$ are higher, often much higher, than those for forecasts from $D(t)/P(t-1)$. For example, the MSE R^2 for forecasts of two- to four-year returns from $D(t)/P(t)$ commonly exceed 0.35, while those for forecasts from $D(t)/P(t-1)$ are typically less than 0.20. The out-of-sample forecasts thus confirm that using the less timely $D(t)/P(t-1)$ to avoid false positive conclusions about forecast power produces regressions that understate the variation of expected returns.

7. Why does forecast power increase with the return horizon?

The out-of-sample MSE R^2 tend to confirm the more extensive evidence from the in-sample R^2 in tables 3 and 4 that the explanatory power of the regressions increases with the return horizon. The in-sample R^2 in tables 3 and 4 and the out-of-sample MSE R^2 in table 5 are 0.07 or less for monthly and quarterly returns, but they are often greater than 0.25 for two- to four-year returns. That the same yields capture more return variance for longer forecast horizons is an interesting and challenging result.

Algebraically, the regression R^2 increase with the return horizon because the variance of the fitted values grows more quickly than the horizon, whereas the variance of the residuals generally grows less quickly than the horizon. Our goal is to explain why.

7.1. The regression fitted values and residuals

In the regressions of returns on dividend yields, the explanatory variable is the same for all return horizons. Thus, as return horizon increases, the variance of the fitted values grows in proportion to the square of the regression slopes. The slopes in tables 3 and 4 increase roughly in proportion to the return horizon out to one or two years, and then more slowly. As noted earlier, this behavior suggests that short-horizon expected returns are autocorrelated but slowly mean-reverting. The persistence of short-horizon expected returns implied by slow mean reversion causes the variances of multiperiod expected returns to grow more than in proportion to the return horizon.

On the other hand, tables 3 and 4 show that for periods after 1940, the residual variances in regressions of $r(t,t+T)$ on $Y(t)$ grow less than in proportion to the return horizon, at least for one- to four-year returns. For

Table 6

Correlations of residuals from regressions of one-year real CRSP value- and equal-weighted NYSE returns on the dividend yield $D(t)/P(t-1)$.[a]

$$r(t+i-1,t+i)=a+bD(t)/P(t-1)+e(t+i-1,t+i)$$

$$\mathrm{Cor}[e(t+i-1,t+i),e(t+j-1,t+j)],\quad i=2,3,4,\quad j=1,2,3$$

Lead	Value-weighted returns Lead j			Equal-weighted returns Lead j		
i	1	2	3	1	2	3
			1927–1986			
2	−0.05			−0.00		
3	−0.30	−0.05		−0.29	−0.00	
4	−0.14	−0.31	0.1	−0.20	−0.26	0.09
			1941–1986			
2	−0.15			−0.18		
3	−0.39	−0.09		−0.43	−0.00	
4	−0.08	−0.39	−0.05	−0.17	−0.35	0.02

[a]The residuals are from regressions that use $D(t)/P(t-1)$ to forecast one-year returns one, two, three, and four years ahead.

$\mathrm{Cor}[e(t+i-1,t+i),e(t+j-1,t+j)]$ is the correlation between the residual for the regression forecast of the one-year return i years ahead and the residual for the regression forecast of the one-year return j years ahead.

The correlations for nominal returns and for the other subperiods in tables 3 and 4 are similar to those shown. Using $D(t)/P(t)$ as the forecast variable produces similar results.

example, the residual standard errors for four-year returns never come close to twice the one-year standard errors. The residual in the regression of the multiyear return $r(t,t+T)$ on $Y(t)$ is the sum of the residuals from regressions of the one-year returns, $r(t,t+1),\ldots,r(t+T-1,t+T)$, on $Y(t)$. If multiyear residual variances grow less than in proportion to the return horizon, the correlations of the residuals from the one-year regressions must on average be negative. The negative correlation is documented in table 6. It has an economic explanation that, along with the persistence of expected returns, completes the story for the predictability of long-horizon returns.

7.2. Stock prices and expected return shocks

Suppose there is a shock at $t+1$ that increases expected returns. Since the shock occurs after the yield $Y(t)$ is set, fitted values from regressions of $r(t+1,t+2),\ldots,r(t+T-1,t+T)$ on $Y(t)$ will tend to underestimate returns after $t+1$, and the residuals will tend to be positive. On the other hand, if expected return shocks generate opposite unexpected changes in prices (the discount-rate effect), the positive shock to expected returns at $t+1$ will tend to produce a negative residual in the regression of the one-year return

$r(t, t+1)$ on $Y(t)$. Thus, because of the discount-rate effect, the residual from the regression of $r(t, t+1)$ on $Y(t)$ is negatively correlated with the residuals from regressions of $r(t+1, t+2), \ldots, r(t+T-1, t+T)$ on $Y(t)$. A similar argument implies that the residuals from the regression of $r(t+k-1, t+k)$ on $Y(t)$ tend to be negatively correlated with the residuals from regressions of one-year returns after $t+k$ on $Y(t)$.

The next section presents further tests for the discount-rate effect, based on estimates of the relation between contemporaneous return and dividend yield shocks.

8. Yields and temporary components of stock prices

8.1. Yield shocks, price shocks, and future expected returns

Table 1 suggests that one-year returns are uncorrelated with dividend changes more than one year ahead. This suggests that $D(t+1)$ is an unbiased (but noisy) measure of the information in $P(t)$ about future dividends, so that $D(t+1)/P(t)$ is relatively free of variation due to dividend forecasts. Thus, the unexpected component of $D(t+1)/P(t)$ can be interpreted as a (noisy) measure of the shock to expected returns at t.

Preliminary tests (not shown) indicated that the highly autocorrelated yields on the value- and equal-weighted portfolios are approximated well by first-order autoregressions (AR1s), with AR1 parameters close to the first-order autocorrelations in table 2. We use residuals from AR1s estimated on end-of-year yields to measure yield shocks,

$$D(t+1)/P(t) = \alpha + \phi D(t)/P(t-1) + v(t-1, t). \tag{8}$$

We use the yield shock $v(t-1, t)$ as a proxy for the expected return shock from $t-1$ to t.

The discount-rate effect implies a negative relation between expected return shocks and contemporaneous returns; an unexpected increase in expected returns drives the current price down. We measure this relation with the slope δ in the regression of $r(t-1, t)$ on $v(t-1, t)$,

$$r(t-1, t) + \gamma + \delta v(t-1, t) + u(t-1, t). \tag{9}$$

We interpret δ as the response of $P(t)$ per unit of the time t yield shock. The slope $\beta(T)$ in the regression of $r(t, t+T)$ on $D(t)/P(t-1)$ then measures the T-period expected future price change due to the changes in expected returns implied by a yield shock. Comparing estimates of δ and $\beta(T)$ allows us to judge the relative magnitudes of the current and expected future price responses to yield shocks. The logic of this approach is that we want estimates of $\beta(T)$ for a long return horizon (we use $T = 4$ years), since the autocorrelation of expected returns implies that a yield shock has a slowly decaying effect on one-period expected future price changes.

Table 7

Tests for a discount-rate effect in stock returns.

Comparisons of the relation between contemporaneous real returns and dividend yield shocks (δ) and the relation between future returns and current dividend yields (b).[a]

$$D(t+1)/P(t) = \alpha + \phi D(t)/P(t-1) + v(t-1,t)$$

$$r(t-1,t) = \gamma + \delta v(t-1,t) + u(t-1,t)$$

$$r(t,t+4) = a + bY(t) + e(t,t+4)$$

			$Y(t) = D(t)/P(t-1)$		$Y(t) = D(t)/P(t)$	
Period	δ	$s(\delta)$	$b(4)$	$s[b(4)]$	$b(4)$	$s[b(4)]$
			Value-weighted real returns			
1927–1986	−22.27	2.71	13.44	5.47	14.43	4.44
1927–1956	−20.42	4.69	23.00	10.40	20.39	5.51
1957–1986	−25.72	2.44	12.48	7.94	16.21	8.88
1941–1986	−20.10	2.15	13.34	4.19	15.71	4.75
			Equal-weighted real returns			
1927–1986	−20.42	3.48	12.64	6.81	18.91	5.45
1927–1956	−17.80	5.95	9.58	11.45	18.93	8.47
1957–1986	−24.73	3.17	20.26	8.22	24.85	8.29
1941–1986	−20.37	2.23	14.19	4.90	20.50	5.16

[a] δ, the contemporaneous response of the return $r(t-1,t)$ to the yield shock $v(t-1,t)$ is estimated with regressions of annual observations on one-year returns on the residuals from a first-order autoregression for the yield. The estimates of $b(4)$, interpreted as the response of future one-year returns to a current yield shock, are from tables 3 and 4. $s(\delta)$ and $s[b(4)]$ are standard errors. The results for nominal returns are similar.

Estimates of δ in (9) must be interpreted cautiously. The lack of correlation between returns and dividend changes more than a year ahead suggests that $D(t+1)/P(t)$ is relatively free of variation due to dividend forecasts. But this does not mean that all variation in $D(t+1)/P(t)$ is due to expected returns. Moreover, whatever its source, variation in $P(t)$ that results in variation in $D(t+1)/P(t)$ tends to produce a negative correlation between $r(t-1,t)$ and the yield shock $v(t-1,t)$. Thus negative estimates of δ are not per se evidence of a discount-rate effect. To infer that negative estimates of δ reflect offsetting changes in current prices related to changes in expected future returns, we need the complementary evidence from estimates of $\beta(T)$ that yields track expected returns so that yield shocks imply expected future price changes of the same sign.

8.2. The estimates

Table 7 shows estimates of δ for real returns on the NYSE value- and equal-weighted portfolios. The estimates are always negative, less than −17.0, and more than 2.9 standard errors from 0.0. Table 7 also shows estimates of

$\beta(T)$ for $T = 4$ years. Despite large standard errors, the estimates are usually more than 2.0 standard errors above 0.0. We conclude from the estimates of δ and $\beta(4)$ that dividend yield shocks are associated with (a) contemporaneous price changes of the opposite sign and (b) expected future price changes of the same sign.

The positive estimates of $\beta(4)$ from regressions of $r(t, t+T)$ on $D(t)/P(t-1)$ are large but typically smaller in magnitude than the negative estimates of δ. The out-of-sample forecasts in table 5 suggest, however, that the $D(t)/P(t-1)$ slopes understate the variation of expected returns because the information in $D(t)/P(t-1)$ is about a year out of date for expected returns measured forward from t. The estimates of $\beta(4)$ for regressions of $r(t, t+4)$ on the more timely $D(t)/P(t)$ are closer in magnitude to (usually within 1.0 standard error of) the estimates of δ.

We interpret the estimates of δ and $\beta(4)$ as suggesting that, on average, the expected future price increases implied by higher expected returns are just offset by the immediate price decline due to the discount-rate effect. Thus, as postulated in Summers (1986) and Fama and French (1987a), positively autocorrelated expected returns generate mean-reverting components of prices. We consider next competing scenarios for such temporary price components.

8.3. Temporary price components

Temporary components of prices and the forecast power of yields are consistent with an efficient market. Suppose investor tastes for current versus risky future consumption and the stochastic evolution of firms' investment opportunities result in equilibrium expected returns that are highly autocorrelated but mean-reverting. Suppose shocks to expected returns and shocks to rational forecasts of dividends are independent. Then a shock to expected returns has no effect on expected dividends or expected returns in the distant future. Thus, the shock has no long-term effect on expected prices. The cumulative effect of a shock on expected returns must be exactly offset by an opposite adjustment in the current price. It follows that mean-reverting equilibrium expected returns can give rise to mean-reverting (temporary) components of stock prices. See Poterba and Summers (1987) for a formal analysis.

On the other hand, temporary components of prices and the forecast power of yields are also consistent with common models of an inefficient market, such as Keynes (1936), Shiller (1984), DeBondt and Thaler (1985), and Summers (1986), in which stock prices take long temporary swings away from fundamental values. In this view, high D/P ratios signal that future returns will be high because stock prices are temporarily irrationally low. Conversely, low D/P ratios signal irrationally high prices and low future returns.

As always, market efficiency per se is not testable. It must be tested jointly with restrictions on the behavior of equilibrium expected returns. [See Fama (1970).] One reasonable restriction is that equilibrium in an efficient market never implies predictable price declines (negative expected nominal returns) for the value- and equal-weighted NYSE portfolios. The behavior of the fitted values for the regressions in tables 3 and 4 supports this hypothesis.

The fitted values from the regressions of nominal returns on dividend yields are rarely negative. For example, when the explanatory variable is the more timely $D(t)/P(t)$, the regressions for equal-weighted returns for all horizons produce a total of six negative fitted values during the 1927–1986 period and no negative fitted values during the 1941–1986 period. The regressions of value-weighted nominal returns on $D(t)/P(t)$ produce no negative fitted values in either period. In both the $D(t)/P(t)$ and the $D(t)/P(t-1)$ regressions, no negative fitted value is close to 2.0 standard errors from 0.0. As a rule at least two-thirds of the return forecasts are more than 2.0 standard errors above 0.0.

A stronger hypothesis is that equilibrium in an efficient market never implies negative expected real returns for the value- and equal-weighted NYSE portfolios. The regression fitted values are more often negative for real returns than for nominal returns, but again no negative forecast of real returns is more than 2.0 standard errors from 0.0, whereas typically more than half of the forecasts are more than 2.0 standard errors above 0.0.

In short, low dividend yields forecast that nominal returns will be relatively low, but they do not forecast that prices will decline. Likewise, the strong forecast power of yields does not imply that expected real returns are ever reliably negative.

8.4. Dividend yields and the autocorrelation of returns

Autocorrelated expected returns and the opposite response of prices to expected return shocks (the discount-rate effect) can combine to produce mean-reverting components of stock prices. Fama and French (1987a) show that mean-reverting price components tend to induce negative autocorrelation in long-horizon returns. Thus, the negative autocorrelation of long-horizon returns in the earlier work is consistent with the positive autocorrelation of expected returns documented here.

But a mean-reverting, positively autocorrelated expected return does not necessarily imply negative autocorrelated returns or a mean-reverting component of prices. If shocks to expected returns and expected dividends are positively correlated, the opposite response of prices to expected return shocks can disappear. In this case, the positive autocorrelation of expected returns will imply positively autocorrelated returns, and time-varying expected returns will not generate mean-reverting price components. Moreover, changes through time in the autocorrelation of expected returns, or in the relation between shocks to expected returns and expected dividends, can change the time-series properties of returns and obscure tests of forecast power based on autocorrelation.

In contrast, as long as yields move with expected returns, regressions of returns on yields can document time-varying expected returns irrespective of changes in the autocorrelation of returns. This may explain why yields have strong forecast power in post-1940 periods, when the autocorrelations of returns in Fama and French (1987a) give weak indications of time-varying expected returns.

Does the variation of expected returns tracked by yields subsume the predictability of long-horizon returns implied by the negative autocorrelation in Fama and French (1987a)? We have estimated multiple regressions of $r(t, t+T)$ on $D(t)/P(t)$ and the lagged return $r(t-T, t)$. The lagged return rarely has marginal explanatory power. Negative slopes for the lagged return are typically less than 1.0 standard error from 0.0. In contrast, as in the univariate regressions, the slopes for the dividend yield in the multiple regressions increase with the return horizon and are typically more than 2.0 standard errors from 0.0 for the 1927–1986 period and for all periods after 1935. Thus including the lagged return in the regressions has no effect on the conclusion that dividend yields have systematic forecast power across different time periods and return horizons.

9. Conclusions

Like previous work, our regressions of returns on dividend yields indicate that time variation in expected returns accounts for small fractions of the variances of short-horizon returns. Dividend yields typically explain less than 5% of the variances of monthly or quarterly returns. An interesting and challenging feature of our evidence is that time variation in expected returns accounts for more of the variation of long-horizon returns. Dividend yields often explain more than 25% of the variances of two- to four-year returns. We offer a simple explanation.

The persistence (high positive autocorrelation) of expected returns causes the variance of expected returns, measured by the fitted values in the regressions of returns on dividend yields, to grow more than in proportion to the return horizon. On the other hand, the growth of the variance of the regression residuals is attenuated by a discount-rate effect: shocks to expected returns are associated with opposite shocks to current prices.

The cumulative price effect of an expected return shock and the associated price shock is roughly zero. On average, the expected future price increases implied by higher expected returns are just offset by the immediate decline in the current price. Thus the time variation of expected returns gives rise to mean-reverting or temporary components of prices.

References

Ball, Ray, 1978, Anomalies in relationships between securities' yields and yield-surrogates, Journal of Financial Economics 6, 103–126.

Blume, Marshall E., 1968, The assessment of portfolio performance: An application of portfolio theory, Ph.D. dissertation (University of Chicago, Chicago, IL).

Campbell, John Y. and Robert Shiller, 1987, The dividend–price ratio and expectations of future dividends and discount factors, Unpublished manuscript (Princeton University, Princeton, NJ).

DeBondt, Werner F.M. and Richard Thaler, 1985, Does the stock market overreact?, Journal of Finance 40, 793–805.

Dow, Charles H., 1920, Scientific stock speculation, The Magazine of Wall Street (New York).

Fama, Eugene F., 1970, Efficient capital markets: A review of theory and empirical work, Journal of Finance 25, 383–417.

Fama, Eugene F., 1981, Stock returns, real activity, inflation, and money, American Economic Review 71, 545–565.

Fama, Eugene F. and Kenneth R. French, 1987a, Permanent and temporary components of stock prices, Journal of Political Economy 96, 246–273.

Fama, Eugene F. and Kenneth R. French, 1987b, Forecasting returns on corporate bonds and common stocks, Working paper (Center for Research in Security Prices, Graduate School of Business, University of Chicago, Chicago, IL).

Fama, Eugene F. and G. William Schwert, 1977, Asset returns and inflation, Journal of Financial Economics 5, 115–146.

Flood, Robert P., Robert J. Hodrick, and Paul Kaplan, 1986, An evaluation of recent evidence on stock market bubbles, Unpublished manuscript (National Bureau of Economic Research, Cambridge, MA).

French, Kenneth R., G. William Schwert, and Robert Stambaugh, 1987, Expected stock returns and volatility, Journal of Financial Economics 19, 3–29.

Hansen, Lars P. and Robert J. Hodrick, 1980, Forward exchange rates as optimal predictors of future spot rates: An econometric analysis, Journal of Political Economy 88, 829–853.

Keim, Donald B. and Robert F. Stambaugh, 1986, Predicting returns in the stock and bond markets, Journal of Financial Economics 17, 357–390.

Keynes, John M., 1936, The general theory of employment, interest, and money (Harcourt, Brace and Company, New York, NY).

Lintner, John, 1956, Distribution of incomes of corporations among dividends, retained earnings and taxes, American Economic Review 46, 97–113.

Miller, Merton H. and Myron S. Scholes, 1982, Dividends and taxes: Some empirical evidence, Journal of Political Economy 90, 1118–1141.

Poterba, James M. and Lawrence Summers, 1987, Mean reversion in stock returns: Evidence and implications, Unpublished manuscript (National Bureau of Economic Research, Cambridge, MA).

Rozeff, Michael, 1984, Dividend yields are equity risk premiums, Journal of Portfolio Management, 68–75.

Shiller, Robert J., 1984, Stock prices and social dynamics, Brookings Papers on Economic Activity 2, 457–498.

Stambaugh, Robert F., 1986, Bias in regressions with lagged stochastic regressors, Unpublished manuscript (University of Chicago, Chicago, IL).

Summers, Lawrence H., 1986, Does the stock market rationally reflect fundamental values?, Journal of Finance 41, 591–601.